AN8083S

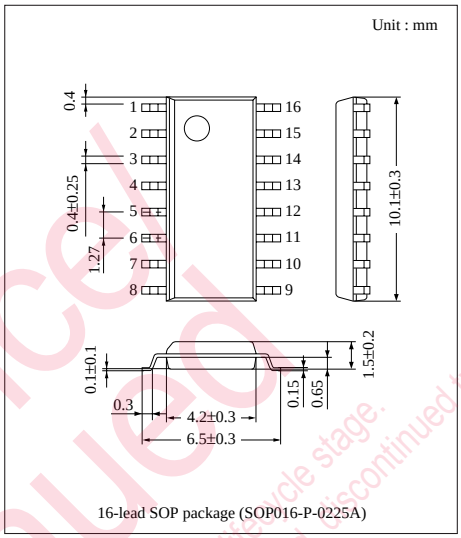
Low Voltage Operation IC for DC-DC Converter

■ Overview

The AN8083S is an IC for controlling a DC-DC converter suitable for the switching power supply of various portable equipments. It can operate with input voltage 1.1V or more.

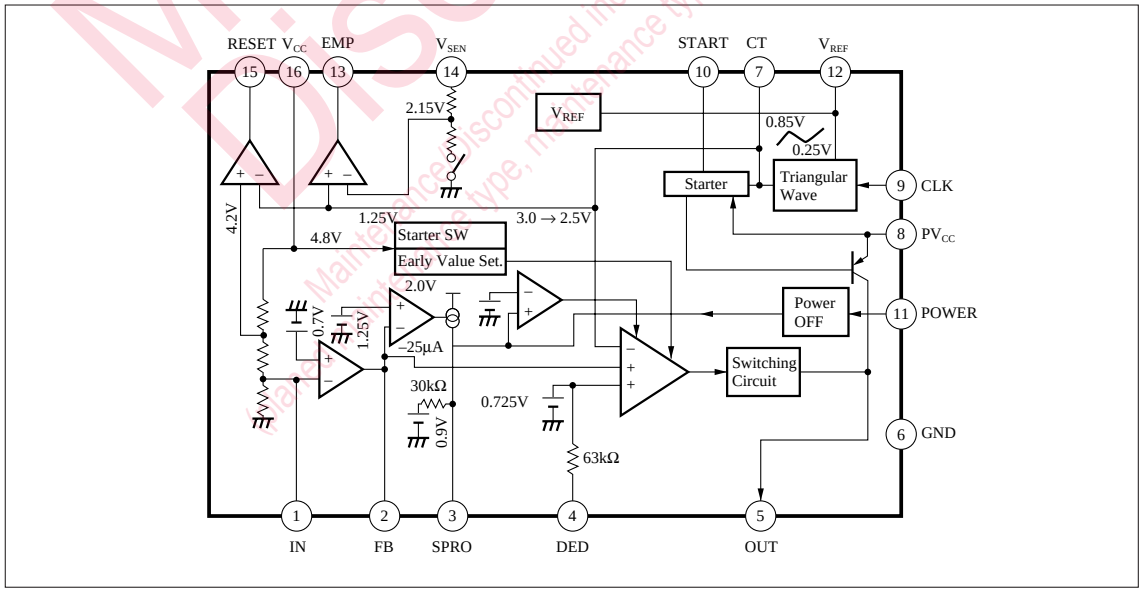
■ Features

- Operatable with low voltage input (PV_{CC}>1.1V)
- Decreased voltage detection circuit built-in
- Short-circuit protection feature built-in
- Provided with reset output
- Synchronizable with outside clock
- Low consumption current in stand-by mode
- Output voltage in secondary side; 4.8V+0.3V (Variable by using external resistance)



16-lead SOP package (SOP016-P-0225A)

■ Block Diagram



■ Absolute Maximum Ratings (Ta=25˚C)

Parameter	Symbol	Rating	Unit
Supply Voltage	V_{CC}	14.4	V
	PV_{CC}	14.4	
Power Dissipation	P_D	380	mW
Operating Ambient Temperature	T_{opr}	–20 ~ +75	˚C
Storage Temperature	T_{stg}	–55 ~ +125	˚C

■ Recommended Operating Range (Ta=25˚C)

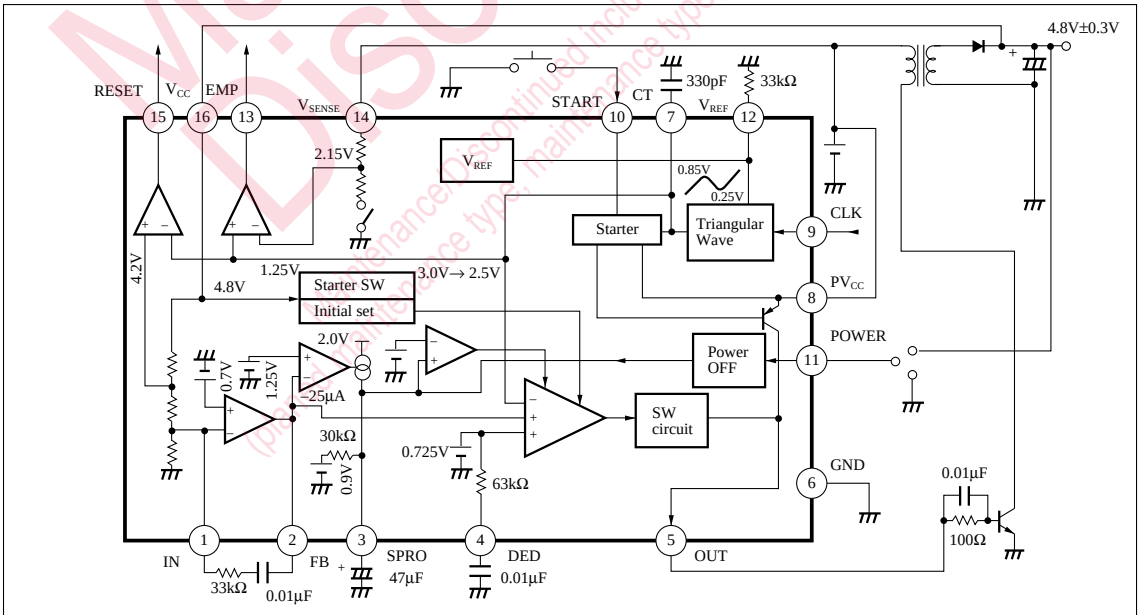
Paramenter	Symbol	Range
Operating Supply Voltage Range	V_{CC}	1.8V ~ 12V
	PV_{CC}	1.1V ~ 12V

■ Electrical Characteristics (Ta=25˚C)

Parameter	Symbol	Condition	min.	typ.	max.	Unit
Power V_{CC} Stand-by Mode Supply Current	I_{PVCC}	V_{CC}=0V, PV_{CC}=3V	—	—	2	µA
Power V_{CC} Operating Mode Supply Current	I_{PVCC}	V_{CC}=3.1V, PV_{CC}=3V	—	1.2	3	mA
Output Voltage	V_O		—	4.8	—	V
Reset Output Threshold Voltage	$V_{TH\ (RESET)}$	PV_{CC}=3V	4	4.2	4.4	V
Decreased Voltage Detection Threshold Voltage	$V_{TH\ (VSEN)}$	PV_{CC}=3V	2.05	2.15	2.25	V
Short-Circuit Protection Operating Voltage	$V_{O\ (SPRO)}$	V_{IN}=0V, V_{POWER}=2V	1.35	—	2.1	V
Short-Circuit Protection Operating Voltage	$V_{O\ (SPRO)}$	V_{IN}=1V, V_{POWER}=0V	1.7	—	3.2	V
Oscillation Frequency in Normal Operation	f_{OSC1}	R_{REF}=33kΩ, CT=330pF	60	70	80	kHz
Oscillation Frequency at Start	f_{OSC2}	R_{REF}=33kΩ, CT=330pF V_{CC}=1.9V, PV_{CC}=3V	80	100	120	kHz
Output Voltage (Normal)	$V_{OH\ (OUT)}$	I_O= –20mA, V_{CT}=0V	1.2	—	1.6	V
Output Voltage (Normal)	$V_{OL\ (OUT)}$	I_O=20mA, V_{CT}=1V	—	—	0.4	V

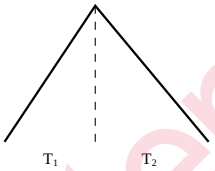
Note) Unless otherwise specified, V_{CC}=4.8V, PV_{CC}=3V

■ Application Circuit

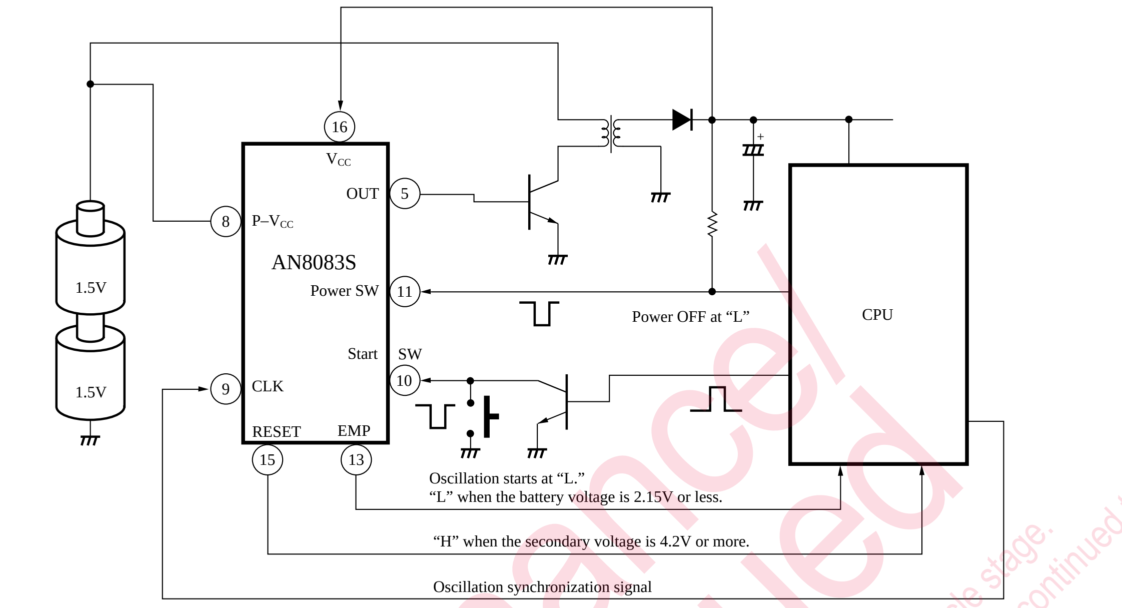


*Connect Pin11 to the secondary side and Pin10 to GND at oscillation start. (Pin10 is always open.)

■ Pin Description

Pin No.	Symbol	Pin Description
1	IN	• Input pin for error amplifier • Threshold voltage ; 0.7V
2	FB	• Output pin for error amplifier
3	SPRO	• Short-circuit protection input pin. If output of error amplifier does not become "L" when $t=CV_{th}/I_{SPRO}$ output of IC is not switched. $I_{SPRO}=25\mu A$, $V_{th}=0.9V$
4	DED	• Dead time control input. Maximum duty ratio set to 85%. (Maximum duty ratio can be changed by installing external resistance between Pins 12 and 4.)
5	OUT	• Switching output pin Output current ; I_O=20mA (max.)
6	GND	• GND pin
7	CT	• Triangular oscillating capacitor pin  $T_1 = \frac{CV}{I\ (Discharged)}$ $T_2 = \frac{CV}{I\ (Charged)}$ $f = \frac{1}{T_1+T_2}$ I Discharged=52μA I Charged=30μA V=0.58V In normal mode
8	PV_{CC}	• DC voltage input pin Operates with 1.2V or more.
9	CLK	• Clock input · It is used to synchronize triangular oscillation with clock input and operates at rise edge of clock. · The threshold level is TTL level. · It is open when not used.
10	START	• Start pin · Starts switching of starter · Threshold voltage, PV_{CC} – 0.9V
11	POWER	• Power ON/OFF pin Output ON/OFF switching pin (Output is off at "L.")
12	V_{REF}	• Reference voltage pin · 1.25V output · Charged and discharged current of triangular oscillation is determined by external R. $I\ (Charged) = \frac{V_{REF}-0.7}{R_{REF}+1k\Omega}$ $I\ (Discharged) = 1.40 \times I\ (Charged)$
13	EMP	• Decreased voltage detection output pin "H" when detected by open collector output form
14	V_{SEN}	• Decreased voltage detection input pin · Threshold voltage ; 2.15V
15	Reset	• Reset output pin · "H" when V_{CC} becomes 4.2V or more · Open collector output form
16	V_{CC}	• DC voltage input pin Operates with 1.8V or more.

■ System Block Diagram



1) When Pin10 becomes "L" by operation of CPU or push switch, oscillation starts and boosted voltage is outputted to the secondary side.
2) When the secondary side voltage exceeds 3.6V, starter circuit is stopped and PWM operation is started by using the voltage in the secondary side as power supply.
3) When the secondary side voltage becomes 4.2V, Pin15 becomes "H" and CPU operation is started.
4) When "L" pulse is sent from CPU to Pin11, oscillation is stopped and it enters the stand-by mode. In this status consumption current is 2μA max.
5) For re-start, when Pin10 becomes "L" by operation of CPU or push switch, oscillation starts.

■ Supplementary Explanation

• Operational Description

When power V_{CC} pin (Pin8) is connected to the supply output and start pin (Pin10) is set to "Low," the triangular oscillation is outputted to CT pin (Pin7) and the rectangular wave to OUT pin (Pin5). In this condition, called start condition, PWM control is not obtained and only oscillation is repeated. By this oscillation at start, supply output is increased. This supply output voltage is inputted to V_{CC} pin (Pin16) of the AN8083S. When the voltage of V_{CC} pin becomes 3V or more, start oscillation is stopped and oscillation in normal operation is outputted. PWM control is started only after entering normal mode. The voltage switching between start and normal operation has 0.5V hysteresis. When power pin (Pin11) is set to "High" in normal operation, normal mode oscillation is started. In this status, output of the supply is 4.8V fixed.

• Other features

1. Short-circuit protection feature

For normal mode oscillation, when output/FB pin (Pin2) of error amplifier is in "High" condition, oscillation is stopped, since the power supply system is judged to be in an abnormal condition. With the time constant of discharged current I_{SPRO} of SPRO pin (Pin3) and capacitor C_{SPRO}, pin voltage is increased, and oscillation is stopped when it becomes 1.25V or more. During this time, when the error amplifier becomes "Low," charged current no longer exits and SPRO is maintained to 0.9V.

2. Decreased voltage detection circuit

When V_{SEN} pin (Pin14) gets 2.15V or less, EMS pin (Pin13) gets "High."

3. Reset output

When V_{CC} pin voltage is 4.2V or more, RST pin (Pin15) gets "High."

• Miscellaneous

1. Method for making output voltage variable

$V_{CC} = 0.7V \times (R_1 + R_2)/R_2$

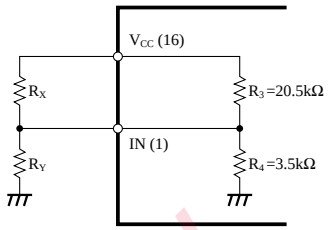
$R_1 = R_X // R_3$

$R_2 = R_Y // R_4$

ex) Where $V_{CC} = 5V$,

$R_X = 51k\Omega$

$R_Y = 7.5k\Omega$



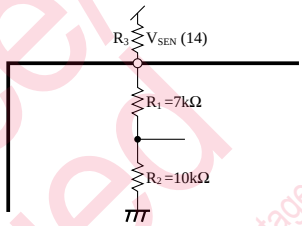
2. Method for making decreased voltage detection variable

$$V_{SEN} = \frac{R_1 + R_2}{R_2} \times 1.25$$

ex) $V_{SEN} = 3V$

$$V_{SEN} = \frac{R_1 + R_2 + R_3}{R_2} \times 1.25$$

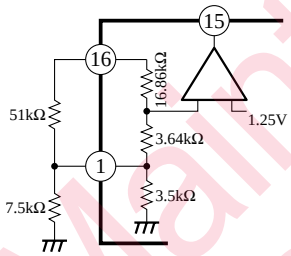
$R_3 = 7k\Omega$



However, take care that an external resistance causes different temperature characteristics.

3. Reset output

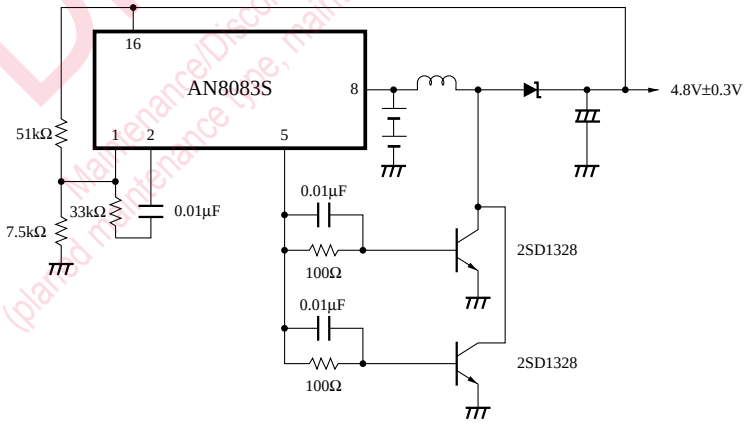
When the output voltage is made variable, detection voltage changes.



$V_{CC} = 4.8V \rightarrow 4.2V$ (No changes)

$V_{CC} = 5V \rightarrow 4.27V$

• Chopper type application



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